MINISTRY OF HEALTH
SINGAPORE

Stroke and Transient Ischaemic Attacks

Assessment, Investigation, Immediate Management and Secondary Prevention

MOH Clinical Practice Guidelines 2/2009

College of Family Physicians Singapore

Academy of Medicine, Singapore

Clinical Neuroscience Society, Singapore

Singapore National Stroke Association

July 2009

Levels of evidence and grades of recommendation

Levels of evidence

Level	Type of Evidence
1^{++}	High quality meta-analyses, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias.
1^{+}	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias.
1^{-}	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias.
2^{++}	High quality systematic reviews of case control or cohort studies. High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2^{+}	Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2^{-}	Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3	Non-analytic studies, e.g. case reports, case series
4	Expert opinion

Grades of recommendation

Grade	Recommendation
A	At least one meta-analysis, systematic review of RCTs, or RCT rated as 1++ and directly applicable to the target population; or A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2^{++}, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1^{++} or 1^{+}
C	A body of evidence including studies rated as 2^{+}, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2^{++}
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2^{+}
GPP (good practice points)	Recommended best practice based on the clinical experience of the guideline development group.

CLINICAL PRACTICE GUIDELINES

Stroke and Transient Ischaemic Attacks

Assessment, Investigation, Immediate Management and Secondary Prevention

MOH Clinical Practice Guidelines 2/2009

Published by
Ministry of Health, Singapore
16 College Road,
College of Medicine Building
Singapore 169854

Printed by
National Photo Engravers

ISBN 978-981-08-3686-3

Available on the MOH website: http://www.moh.gov.sg/cpg

Statement of Intent

These guidelines are not intended to serve as a standard of medical care. Standards of medical care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge advances and patterns of care evolve.

The contents of this publication are guidelines to clinical practice, based on the best available evidence at the time of development. Adherence to these guidelines may not ensure a successful outcome in every case. These guidelines should neither be construed as including all proper methods of care, nor exclude other acceptable methods of care. Each physician is ultimately responsible for the management of his/her unique patient, in the light of the clinical data presented by the patient and the diagnostic and treatment options available.

Contents

Foreword

Stroke is a major cause of death and disability globally. Annually, 15 million people worldwide suffer a stroke and of these, 5 million die and another 5 million are left permanently disabled, placing a substantial emotional and economic burden on the family as well as the community. In Singapore, stroke is the fourth leading cause of death, with a prevalence of 4% among adults aged 50 years and above. In addition, it is the biggest cause of long term disability. Hence, it is vital that every effort is employed to prevent stroke, and if cases had occurred, to administer evidence-based treatment to achieve the desired clinical outcomes.

This edition of the guidelines updates and expands the March 2003 guidelines. In addition to incorporating new evidence in existing chapters, the section on rehabilitation has been expanded into its own chapter. An important new section on lifestyle modification has also been added.

These guidelines form a comprehensive review of the assessment and management of stroke and TIAs. I hope that these guidelines will be useful in helping doctors and medical professionals in treating stroke patients.

PROFESSOR K SATKU
DIRECTOR OF MEDICAL SERVICES

Executive summary of recommendations

Details of recommendations can be found in the main text at the pages indicated.

Assessment and investigation of acute stroke and transient ischaemic attack

A A full medical assessment should be undertaken and multidisciplinary assessment considered for all patients with acute stroke or transient ischaemic attack (TIA) to define the nature of the event, the need for investigations, further management and rehabilitation (pg 11).

Grade A, Level 1++

C A swallowing assessment should be undertaken at home or in hospital as part of the clinical assessment of stroke (pg 12).

Grade C, Level 2+

GPP Local written protocols should be available for healthcare institutions, setting out indications for both routine and more specialised investigations (pg 12).

GPP

C&GPP All patients with transient ischaemic attack or an acute stroke syndrome should have a computed tomography or magnetic resonance imaging brain scan as soon as possible*, preferably within 24 hours† (pg 14).

***Grade C, Level 2+**
†GPP

Immediate management following acute stroke

A Intravenous recombinant tissue plasminogen activator is recommended for ischaemic stroke patients within 3 hours of stroke onset and without contraindication to this therapy, in centres with appropriate facilities and expertise (pg 16).

Grade A, Level 1+

A Intra-arterial thrombolysis is an option for treatment in selected patients within 6 hours of onset of major middle cerebral artery infarction, who are otherwise not eligible for intravenous thrombolysis (pg 16).

Grade A, Level 1+

A The routine use of heparins in acute ischaemic stroke, including cardioembolic strokes, is not recommended (pg 16).

Grade A, Level 1+

A Antiplatelet therapy, normally aspirin, should be prescribed immediately for patients who have sustained an ischaemic stroke (pg 17).

Grade A, Level 1+

A Early decompressive surgery is an option for treatment in patients aged between 18-60 years, with a space-occupying middle cerebral artery infarction (pg 17).

Grade A, Level 1++

A The routine use of drugs to limit neural damage, including the use of corticosteroids, neuroprotectants, plasma volume expanders, barbiturates and streptokinase, is of no proven benefit and should be discouraged (pg 17).

Grade A, Level 1+

GPP Mild and moderately elevated blood pressure should not routinely be lowered in the acute phase of stroke as this may worsen outcome (pg 18).

GPP

GPP Patients with hemorrhagic strokes who are receiving anticoagulants or have received recent thrombolytic therapy or those with bleeding diastheses require urgent correction of coagulation defects. Thrombolytics, anti-platelet therapy and anticoagulants should be discontinued (pg 18).

GPP

D Urgent neurosurgical assessment should be available for selected patients, such as those with large cerebellar infarcts or haemorrhage or acute hydrocephalus, and for selected cases of cerebral haemorrhage (pg 19).

Grade D, Level 4

GPP Monitoring and management of hyperglycaemia is recommended for all patients with acute ischaemic stroke (pg 19).

GPP

B If glucose lowering therapy is initiated, close monitoring of glucose concentrations to avoid hypoglycaemia is recommended (pg 19).

Grade B, Level 1+

GPP Hypoglycaemia in patients with acute ischaemic stroke should be treated with a goal to achieve normoglycaemia (pg 19).

GPP

D When fever occurs in patients with acute ischaemic stroke, the temperature should be lowered and the cause ascertained and treated (pg 20).

Grade D, Level 4

D Good hydration and early mobilisation is recommended for all stroke patients to reduce deep venous thrombosis and pulmonary embolism (pg 21).

Grade D, Level 2+

A Antiplatelet therapy is recommended in all patients with ischaemic stroke to reduce deep venous thrombosis and pulmonary embolism (pg 21).

Grade A, Level 1+

Secondary prevention following acute ischaemic stroke and transient ischaemic attack

A Antiplatelet therapy should be continued in the long term for the secondary prevention of recurrent stroke and other vascular events in patients who have sustained an ischaemic cerebrovascular event (pg 22).

Grade A, Level 1++

A Long term anticoagulation with adjusted dose warfarin (target INR 2.5, range 2.0-3.0) is recommended in the secondary prevention of stroke following atrial fibrillation unless there are contraindications (pg 23).

Grade A, Level 1++

A In patients with cardioembolic strokes and definite contraindications to long term anticoagulation, antiplatelet therapy should be considered (pg 23).

Grade A, Level 1++

A Patients with moderate or severe internal carotid artery stenosis ipsilateral to a carotid transient ischaemic attack or non-disabling ischaemic stroke should be considered for carotid endarterectomy by an experienced surgeon (pg 24).

Grade A, Level 1++

A Carotid artery stenting may be considered in patients who are not suitable for carotid endarterectomy (pg 24).

Grade A, Level 1++

C Intracranial angioplasty with or without stenting may be considered as a treatment option for symptomatic patients who have > 50% stenosis and who have failed medical therapy (pg 25).

Grade C, Level 2+

A Blood pressure lowering should be considered after the acute phase of stroke (pg 25).

Grade A, Level 1++

A Patients with ischaemic stroke or transient ischaemic attack are reasonable candidates for treatment with a statin agent to reduce the risk of vascular outcomes. However, caution should be exercised for patients with haemorrhagic stroke (pg 26).

Grade A, Level 1++

A&B Glucose control is recommended to near normoglycaemic levels among diabetics with ischaemic stroke or transient ischaemic attack to reduce microvascular complications* and possibly macrovascular complications† (pg 27).

***Grade A, Level 1+**
†Grade B, Level 2++

D&GPP Smoking cessation, limited alcohol consumption, weight control, regular physical activity, and a diet rich in fruits, vegetables, fish oil and low fat dairy products may be beneficial for reducing the risk of ischaemic stroke and transient ischaemic attack (pg 27).

Grade D, Level 4
GPP

Rehabilitation

A Stroke patients should receive organized inpatient multidisciplinary rehabilitation (pg 28).

Grade A, Level 1+

B Stroke patients should receive early rehabilitation (pg 28).

Grade B, Level 2++

A If able to do so, stroke patients should be encouraged to participate in more intensive rehabilitation particularly in the first six months (pg 28).

Grade A, Level 1+

A Stroke rehabilitation should include physiotherapy and occupational therapy (pg 29).

Grade A, Level 1+

A Dysphagia therapy is recommended for all acute stroke patients with impaired swallowing function (pg 29).

Grade A, Level 1+

D Speech and language therapy may be considered for poststroke communication disorder but there is presently no clear evidence for its efficacy (pg 29).

Grade D, Level 3

A Constraint-induced movement therapy is recommended for patients with upper limb paralysis who are able to tolerate the treatment regime (pg 30).

Grade A, Level 1+

C Body weight support treadmill ambulation or acupuncture may be considered but there is presently no clear evidence for its efficacy (pg 30).

Grade C, Level 2+

Implications for service delivery

A Patients with transient ischaemic attack or minor stroke should be referred for urgent assessment in specialised clinics (pg 31).

Grade A, Level 1+

A Patients who have suffered an acute stroke should be admitted to a Stroke Unit (pg 31).

Grade A, Level 1++

A Acute inpatient care for patients admitted to hospital with a stroke should be organised as a multidisciplinary stroke service based in designated stroke units (pg 32).

Grade A, Level 1++

1 Introduction

1.1 Epidemiology

Stroke is the second leading cause of death world-wide.[1] It is presently the fourth leading cause of death in Singapore, accounting for approximately 10 to 12% of all deaths, and a crude death rate of 40.4/100 000[2] Our incidence of stroke is 1.8/1000 person-years[3], and prevalence is 3.65% among adults aged 50 years and above. Data from our Ministry of Health shows a rise in the number of admissions to hospitals for cerebrovascular disorders (CVD), from 3732 in 1986 to 9530 in 2007.[4,5] As some patients may prefer to remain at home rather than go to hospital, the actual numbers are probably higher. With the aging of the population, the burden of stroke is expected to rise.[6]

CVD is not a homogeneous disease. There are clear pathological sub-types – transient ischaemic attack (TIA), cerebral infarction, primary intracerebral haemorrhage and subarachnoid haemorrhage - with more than 100 potential underlying causes. In Singapore, over 74% of strokes are due to cerebral infarction, about 24% result from primary intracerebral haemorrhage and approximately 2% are due to subarachnoid haemorrhage.[7,8]

CVD can affect men and women of any age and race. Its manifestations range from a minor episode lasting less than 24 hours (transient ischaemic attack), to a major life threatening or disabling event, and even death. The survivors of first and subsequent strokes will either make a complete recovery or will have varying degrees of disability. About 63% of Singapore stroke survivors are still moderately or severely disabled 3 months after the stroke.[9]

1.2 Need for guidelines on CVD management

Active research into various aspects of stroke has yielded useful information, particularly with regard to the appropriateness of certain investigations and treatment modalities. In view of this, evidence-based clinical practice guidelines for the management of stroke were published in 1999, so that appropriate care can be provided to stroke patients in Singapore wherever they may be managed.

With the availability of new information, this update of the guidelines has been developed. The guidelines also include the management of transient ischaemic attacks as transient ischaemic attacks are harbingers of stroke. Transient ischaemic attacks may be considered as being at one end of the spectrum of cerebrovascular disorders, the other end being a devastating stroke. Transient ischaemic attacks may be viewed as "mini-strokes", and as such the approach to the management of transient ischaemic attacks closely resembles the approach to stroke.

1.3 Scope of the guidelines

These guidelines address the assessment, investigations, immediate management and strategies for secondary prevention of stroke. Areas not addressed by these guidelines are:

- primary prevention - this important issue is common to all vascular diseases
- subarachnoid haemorrhage - investigation and initial management is different from other types of stroke
- stroke in young people - these patients require special investigations beyond those discussed in these guidelines.

These guidelines make recommendations which involve the clinical practice of medical, nursing and paramedical staff. The principles identified should form the basis for local discussion and facilitate the development of local protocols. Some aspects require the involvement of primary and secondary care professionals to develop a common protocol for the interface between the services.

1.4 Objectives of the guidelines

The primary aim of these guidelines is to assist individual clinicians, hospital departments and hospital administrators in producing local protocols for:

(a) assessment, investigation and immediate management of individuals with a transient ischaemic attack or acute stroke (other than a subarachnoid haemorrhage)

(b) secondary prevention and risk factor management following a transient ischaemic attack or acute stroke

The secondary aim of these guidelines is to suggest methods for implementation and for clinical audit. These guidelines are in keeping with the goals of health care for stroke patients, which are to:

- reduce the incidence of stroke through primary prevention.
- reduce case fatality following a stroke.
- implement secondary prevention strategies to prevent a future vascular event.
- reduce the level of disability due to stroke.

1.5 Who the guidelines are for

These guidelines are developed for all health care professionals involved in the care of the stroke patient, including doctors, nurses, therapists, dieticians, medical social workers and hospital and health care administrators. They can be applied in primary care and in hospital-based and shared-care settings.

1.6 Development process of the guidelines

The workgroup tasked with developing and updating these guidelines comprises specialists from the fields of neurology, neurosurgery, neuroradiology, rehabilitation and family medicine, as well as a nurse, an occupational therapist, and a patient advocate from the public. The guidelines are based on the Scottish Intercollegiate Guidelines Network's Clinical Practice Guidelines on the Management of Patients with Stroke[10]. These guidelines were reviewed and modified to meet local needs. New information in recent publications that impact on patients care were also reviewed and included.

1.7 What's new in the revised guidelines

The major changes and additions in this guideline are:

- Section 1.1 – Information on the epidemiology of stroke in Singapore has been updated.
- Section 2.5 – The recommendations on brain imaging now includes MRI with greater emphasis that brain scanning should be performed as soon as possible.
- Section 3.1 – The recommendation on intravenous thrombolytic therapy has been updated. Recommendations on intra-arterial thrombolytic therapy, mechanical clot retrieval and decompressive surgery have been added.

- Section 3.5 – This section on medical management has been updated. Recommendation on venous thromboembolism has been added.
- Sections 3.1 and 4.1 – The evidence on antiplatelet therapy has been updated.
- Section 4.4 – This section on carotid artery stenting has been added.
- Section 4.5 – This section on intracranial angioplasty and stenting is new.
- Section 4.7 – This section on cholesterol lowering after the acute phase of stroke has been updated.
- Section 4.8 – This section on glucose control has been updated.
- Section 4.9 – This section of lifestyle modification has been added.
- Section 5 – Rehabilitation has been re-classified as an independent section by itself. The contents have been extensively revised and updated. Recommendations on physiotherapy, occupational therapy, dysphagia therapy, speech and language therapy and constraint-induced movement therapy have been added.

2 Assessment and investigation of acute stroke and transient ischaemic attack

The results of assessment and investigation should answer the following questions:

(1) Is this a vascular event, i.e. a stroke or transient ischaemic attack (TIA)?
(2) Which part of the brain is affected?
(3) Is it an ischaemic or haemorrhagic vascular event?
(4) What is the cause of the vascular event?
(5) What functional and social problems does this cause the patient?
(6) What other medical problems co-exist with and affect the management of the stroke?
(7) What facilities are required for the management of this patient?

This process should be performed by a multidisciplinary team, supported by diagnostic and imaging facilities, with access to specialist stroke services including interventional neuroradiology and neurosurgery.

2.1 Medical assessment

An acute stroke or transient ischaemic attack can be diagnosed reliably only after a doctor has taken a good history and performed a physical examination. The clinical assessment will guide further management regarding the necessity for hospital referral, admission and intervention. Such an approach should result in answering questions (1), (2), (6) and (7) in the above list. *(See also section 2.5)*

2.2 Multidisciplinary assessment

Multidisciplinary assessment, as part of the organised stroke unit care, involving nursing and other medical professionals, should begin as soon as possible in the management of a patient with a stroke. This will contribute to answering question (5) above.[11,12]

A A full medical assessment should be undertaken and multidisciplinary assessment considered for all patients with acute stroke or transient ischaemic attack (TIA) to define the nature of the event, the need for investigations, further management and rehabilitation.

Grade A, Level 1++

2.3 Swallowing assessment

Dysphagia, a potentially serious consequence of stroke, may go unrecognised unless patients are systematically screened for it. Approximately a third of patients with hemispheric stroke and about two thirds of those with brainstem stroke have dysphagia.[13,14] The mortality rate for patients with dysphagia is high: 46% of patients admitted with acute stroke and dysphagia die within six weeks. Dysphagia reflects the severity of the stroke and also contributes to a higher mortality through aspiration pneumonia.

Assessment of swallowing by trained staff should be undertaken either at home or in hospital before any oral intake is permitted. Nurses working in specialist units may be trained to perform an initial dysphagia screening test. Patients with swallowing defects should be referred to a speech and language therapist.

C A swallowing assessment should be undertaken at home or in hospital as part of the clinical assessment of stroke.

Grade C, Level 2+

2.4 Investigations

Investigations are undertaken:

- to confirm the nature of the vascular event [question (1) above] and to elucidate upon the underlying cause [questions (3) and (4)]
- to determine the appropriate strategy for acute intervention and secondary prevention
- to identify prognostic factors.

GPP Local written protocols should be available for healthcare institutions, setting out indications for both routine and more specialised investigations.

GPP

2.5 Neuroimaging

Neuroimaging by computed tomography (CT) or magnetic resonance imaging (MRI) is essential for accurate stroke diagnosis.[15] Both these modalities allow a definitive stroke diagnosis and the differentiation of ischaemic from haemorrhagic stroke. They also allow the exclusion of stroke mimics, e.g. brain tumours, trauma and subdural hematoma.
CT is the most widely used technique because of its widespread availability, fast scanning time and suitability for all except the most restless patient. It permits accurate stroke localization and has some prognostic value in acute stroke interventions, e.g. risk of haemorrhage following thrombolysis.[16,17] Adaptations of the CT technique using iodinated contrast allow visualization of the cerebral vessels (CT angiography)[18] and estimation of brain perfusion (perfusion CT).[19]

MRI has the advantage of avoiding ionizing radiation, superior spatial resolution and superior sensitivity in the diagnosis of small cortical infarcts, small deep infarcts and posterior fossa strokes.[20] MRI is also better in the early diagnosis of acute ischaemic strokes.[21] Multimodality MRI allows the differentiation of acute from chronic ischaemic strokes (diffusion weighted imaging, DWI)[22-24], the detection of small remote bleeds (gradient echo imaging), provides greater insight into stroke mechanism and evolution as well as allows an assessment of brain perfusion without the use of iodinated contrast (perfusion weighted imaging).[25,26] Imaging of the intracranial and extracranial cerebral vasculature (arterial and venous) is also easily and rapidly performed with MR Angiography.

Contraindications to MRI include claustrophobia, cardiac pacemakers, some metal implants, patients on conventional ventilators and the restless patient. MRI may be more costly, with longer imaging time compared to plain CT.

Other imaging modalities that can provide additional useful information include Doppler carotid ultrasound, transcranial Doppler ultrasound and digital subtraction angiography.

All patients with transient ischaemic attack or an acute stroke syndrome should have a CT or MRI brain scan as soon as possible unless there are good reasons not to do so. Where a patient is a potential candidate for acute thrombolysis, a CT or MRI of the brain should be requested urgently to

enable the scan to be completed within three hours of stroke onset.[27] The patient with impaired consciousness or deteriorating neurological status should also be accorded first priority for neuroimaging because there may be a role for urgent surgical intervention.

C&GPP All patients with transient ischaemic attack or an acute stroke syndrome should have a computed tomography or magnetic resonance imaging brain scan as soon as possible*, preferably within 24 hours†.

***Grade C, Level 2+**
†GPP

3 Immediate management following acute stroke

3.1 Cerebral infarct

A randomised study of intravenous recombinant tissue plasminogen activator (rtPA) in cerebral infarction demonstrated significant improvement in functional outcome in selected patients treated in specialist units within 3 hours of the onset of ischaemic stroke.[28] Favourable outcomes were achieved in 31% to 50% of patients treated with rtPA, compared with 20% to 38% of patients given placebo. The benefit was maintained 1 year after stroke.[29] Treatment carries the risk of symptomatic brain haemorrhage which is associated with a high rate of mortality. Patients with mild to moderate strokes (NIHSS score <20) and persons younger than 75 years of age had the greatest potential for a favourable response to treatment. It is safe and effective in routine clinical practice when used for acute ischaemic stroke within 3 hours of stroke onset in centres with different levels of experience, provided established criteria are strictly followed.[30] The use of streptokinase is contraindicated in view of its lack of beneficial effect on mortality and morbidity.[31]

A recently published study showed that intravenous rtPA therapy commenced between 3 to 4.5 hours after stroke onset was also associated with a significant increase in favourable outcomes[32], but the benefit achieved was diminished compared to rtPA initiated within 3 hours. It is therefore recommended that intravenous rtPA should be initiated as soon as possible in selected patients determined to be good candidates to receive such therapy within 3 hours of stroke onset, with possible extension of the treatment time window to 4.5 hours in the near future when more data from local and international centres confirm the efficacy and safety of this therapy in the extended time-window. Other means to extend the time window for intravenous thrombolysis beyond 3 hours using novel agents[33] or MR imaging for patient selection have yet to show efficacy.[34]

Results of a prospective randomised, placebo controlled trial evaluating the effectiveness of intra-arterial prourokinase in patients with stroke in the middle cerebral artery territory of < 6 hours duration, demonstrated better clinical outcomes in the prourokinase group versus the placebo group (40% versus 25% in respective groups having a 90 day modified Rankin Scale of 0-2). This was despite a slightly higher rate (10%) of haemorrhage in the prourokinase group versus the placebo group (2%).[35]

Treatment requires the patient to be at an experienced stroke centre with immediate access to cerebral angiography and qualified interventionalists.

Mechanical devices (MERCI) may be effective in clot retrieval and ultrasound-enhanced systemic thrombolysis may improve recanalisation although no study has demonstrated an improved clinical outcome.[36-39]

A Intravenous recombinant tissue plasminogen activator is recommended for ischaemic stroke patients within 3 hours of stroke onset and without contraindication to this therapy, in centres with appropriate facilities and expertise.

Grade A, Level 1+

A Intra-arterial thrombolysis is an option for treatment in selected patients within 6 hours of onset of major middle cerebral artery infarction, who are otherwise not eligible for intravenous thrombolysis.

Grade A, Level 1+

The use of heparins (unfractionated heparins, low molecular weight heparin or heparinoids) in acute ischaemic stroke, including those which are cardioembolic in aetiology, is not routinely recommended as it does not reduce mortality in stroke patients. The reduction in recurrent ischaemic stroke associated with heparin therapy is completely offset by the increase in symptomatic intracranial haemorrhage.[40,41] The efficacy of heparins in large artery stroke requires further investigation.[42]

A The routine use of heparins in acute ischaemic stroke, including cardioembolic strokes, is not recommended.

Grade A, Level 1+

Early initiation of aspirin (within 48 hours) after ischaemic stroke reduces stroke recurrence in the early post-stroke period. It also improves outcome, with a significant decrease in death or dependency, and a 1% absolute increase in complete recovery in treated patients.[43-45]

A Antiplatelet therapy, normally aspirin, should be prescribed immediately for patients who have sustained an ischaemic stroke.

Grade A, Level 1+

Malignant infarction of the middle cerebral artery is associated with an 80% mortality rate. A pooled analysis of 3 randomised controlled trials showed that decompressive surgery improved functional outcome and reduced mortality when undertaken within 48 hours of stroke onset in patients aged between 18-60 years, with a space-occupying middle cerebral artery (MCA) infarction. The decision to perform decompressive surgery should be individualised for every patient. Information about quality of life of survivors will help to guide decision.[46]

A Early decompressive surgery is an option for treatment in patients aged between 18-60 years, with a space-occupying middle cerebral artery infarction.

Grade A, Level 1++

Corticosteroids have been used in attempts to reduce the level of cerebral oedema associated with acute stroke. However, there is no evidence that the administration of steroids improves outcome.[47-49]

Haemodilution techniques have been used in attempts to increase cerebral perfusion in patients with acute stroke. No beneficial effect has been found.[50]

The rationale of therapy with neuroprotectants in patients with acute ischaemic stroke is that neuronal damage may be prevented. No benefit has been found to be associated with this type of therapy.[51]

A The routine use of drugs to limit neural damage, including the use of corticosteroids, neuroprotectants, plasma volume expanders, barbiturates and streptokinase, is of no proven benefit and should be discouraged.

Grade A, Level 1+

3.2 Blood pressure

Both extremely high and low blood pressures are associated with poor outcome.[52,53] However, in a number of randomised controlled trials, a reduction of blood pressure which occurred as a side effect of treatment was associated with a worsening of outcome.[54] It is unclear whether this is as a result of the trial medication or an effect of blood pressure lowering.

The current recommendation is to carefully treat hypertension if SBP > 220 mmHg or DBP > 120 mmHg. Exceptions include the stroke patient who has been given thrombolytic agent, has hypertensive encephalopathy, aortic dissection, acute renal failure, acute myocardial infarction, or acute pulmonary edema.[55] Conversely, persistent hypotension should be corrected speedily. [55]

GPP Mild and moderately elevated blood pressure should not routinely be lowered in the acute phase of stroke as this may worsen outcome.

GPP

3.3 Intraparenchymal haemorrhage (excluding subarachnoid haemorrhage)

GPP Patients with hemorrhagic strokes who are receiving anticoagulants or have received recent thrombolytic therapy or those with bleeding diastheses require urgent correction of coagulation defects. Thrombolytics, anti-platelet therapy and anticoagulants should be discontinued.

GPP

3.4 Neurosurgical intervention

Early surgical evacuation of spontaneous supratentorial intraparenchymal hematomas was not shown to be better than conservative treatment.[56] Surgical evacuation of intraparenchymal hematomas could be considered, if the hematoma is thought to be causing clinical deterioration. Further research is needed to clarify this type of intervention.[57,58]

Ventricular shunting and decompression surgery should be considered in patients with acute hydrocephalus associated with cerebellar stroke due to compression of the aqueduct of Sylvius by blood or oedema.[59]

D Urgent neurosurgical assessment should be available for selected patients, such as those with large cerebellar infarcts or haemorrhage or acute hydrocephalus, and for selected cases of cerebral haemorrhage.

Grade D, Level 4

3.5 Medical management

Persistent hyperglycaemia (>7.8 mM) is common among diabetic as well as non-diabetic individuals after acute stroke and has been associated with poorer outcomes.[60] To date, the only randomized controlled trial performed has not demonstrated the benefit of a glucose-potassium-insulin infusion to maintain normoglycaemia.[61] During acute stroke, if glucose lowering therapy is initiated, close monitoring of glucose concentrations to avoid hypoglycaemia is recommended.

GPP Monitoring and management of hyperglycaemia is recommended for all patients with acute ischaemic stroke.

GPP

B If glucose lowering therapy is initiated, close monitoring of glucose concentrations to avoid hypoglycaemia is recommended.

Grade B, Level 1+

Hypoglycaemia

It is generally agreed that hypoglycaemia should be treated in patients with acute ischaemic stroke. The goal is to achieve normoglycaemia. Marked elevation of blood glucose levels should be avoided.

GPP Hypoglycaemia in patients with acute ischaemic stroke should be treated with a goal to achieve normoglycaemia.

GPP

Fever

Fever after acute ischaemic stroke is associated with an increased risk of morbidity and mortality. The poor outcome may be secondary to enhanced release of neurotransmitters and increased free radical production.[62,63] The common causes of fever are chest or urinary tract infections.[64] Paracetamol is modestly effective in lowering temperature in acute stroke.[65]

D When fever occurs in patients with acute ischaemic stroke, the temperature should be lowered and the cause ascertained and treated.

Grade D, Level 4

Venous thromboembolism

Deep venous thrombosis (DVT) is common in the immobilized stroke patient. Asymptomatic DVT has been estimated to occur in 40-50% of acute stroke patients. Ultrasound studies in an Asian population detected DVT in 30% to 45% of patients in the first 30 days following acute stroke.[66] However, clinical evidence of deep venous thrombosis was seen in less than 5% while symptomatic embolism occurred in <1%.

Measures that have been suggested to prevent DVT include early mobilization, good hydration, compression leg stockings, mechanical compression devices, antiplatelet agents, and anticoagulation.

Early mobilization and good hydration appears rational but have not been subjected to clinical trial in the acute stroke setting. The use of compression leg stockings has been shown to reduce DVT in travellers on long flights and venous thromboembolism in surgical patients[67,68] but its efficacy in acute stroke has not been proven.[69]

A recent trial of thigh-length, graduated compression stockings resulted in a non-significant absolute reduction in DVT.[70] The patients on the thigh length compression stockings had significantly more skin breaks, ulcers, blisters and skin necrosis. Mechanical compression devices have been shown to be effective in surgical patients but has never been subjected to trial in stroke.[71]

The use of aspirin in acute ischaemic stroke has been shown to reduce deep venous thrombosis by 29% to 39% and pulmonary embolism (PE) by 43% to 64%.[45,72-74]

Systematic reviews of randomized controlled trials show that heparin [low dose unfractionated heparin as well as low-molecular-weight heparin (LMWH)] reduces the risk of asymptomatic DVT after stroke.[75-77] However, the small non-significant reduction in pulmonary embolism (PE) is more than offset by an increase in intracranial and extracranial haemorrhage.[75] A recent study showed that LMWH may be safer than subcutaneous unfractionated heparin.[78]

D Good hydration and early mobilisation is recommended for all stroke patients to reduce deep venous thrombosis and pulmonary embolism.

Grade D, Level 2+

A Antiplatelet therapy is recommended in all patients with ischaemic stroke to reduce deep venous thrombosis and pulmonary embolism.

Grade A, Level 1+

4 Secondady prevention following acute ischaemic stroke and transient ischaemic attack

4.1 Antiplatelet therapy

Long-term antiplatelet therapy reduces the risk of serious vascular events (recurrent stroke, myocardial infarction or vascular death) following an ischaemic stroke or transient ischaemic attack by 22%; 36 serious vascular events will be avoided over two years per 1000 patients with previous stroke or transient ischaemic attack.[79]

Aspirin was the most widely studied antiplatelet drug, with doses of 75-150 mg daily being at least as effective as higher daily doses. The effects of doses lower than 75 mg daily were less certain.[79]

Other antiplatelet agents proven beneficial in randomised clinical trials include ticlopidine, clopidogrel, and dipyridamole (alone or in combination with aspirin).[80-84] There is evidence from large scale randomised controlled trials that clopidogrel or the combination of aspirin and dipyridamole may be superior to aspirin alone in secondary prevention after stroke.[82-84]

The combination of aspirin and clopidogrel has not been demonstrated to be superior to aspirin or clopidogrel alone and cannot be recommended for routine general use in stroke patients.[85,86]

A Antiplatelet therapy should be continued in the long term for the secondary prevention of recurrent stroke and other vascular events in patients who have sustained an ischaemic cerebrovascular event.

Grade A, Level 1++

4.2 Anticoagulation therapy

Oral anticoagulation with warfarin is highly effective in the secondary prevention of cardioembolic stroke.

The commonest cause of cardioembolic stroke is atrial fibrillation. Oral anticoagulation is more effective than anti-platelet agents (single or in combination) in the primary and secondary prevention of stroke in persons with atrial fibrillation. This is true for both permanent as well as paroxysmal atrial fibrillation. Although anticoagulation use is associated with a similar two-thirds risk reduction compared to control in primary and secondary stroke prevention, a much larger absolute stroke reduction is achieved in the atrial fibrillation patient who has already suffered a stroke or transient ischaemic attack (4% versus 12%)[87] compared to the patient was has no prior event (1.4% versus 4.5%).[88]

Long term anticoagulation with adjusted dose warfarin (target INR 2.5, range 2.0-3.0) is indicated in the secondary prevention of stroke following atrial fibrillation unless there are contraindications.[89,90] A lower target INR of 2.0 (range 1.6-2.5) may be preferred in frail elderly (>75 years old) patients or who are judged to have an increased risk of haemorrhagic complications.[91] In patients with definite contraindications to long term anticoagulation, antiplatelet therapy should be considered.

In each patient, a careful balance of the benefits and risks of long term anticoagulation must be considered. Contraindications to long term anticoagulation includes a) the frail elderly patient at high risk for falls b) active peptic ulcer disease c) poor access to anticoagulation monitoring or poor compliance with treatment.

A Long term anticoagulation with adjusted dose warfarin (target INR 2.5, range 2.0-3.0) is recommended in the secondary prevention of stroke following atrial fibrillation unless there are contraindications.

Grade A, Level 1++

A In patients with cardioembolic strokes and definite contraindications to long term anticoagulation, antiplatelet therapy should be considered.

Grade A, Level 1++

4.3 Carotid endarterectomy

The role of carotid endarterectomy was studied in 3 large randomised controlled trials.[92] When combined with aspirin, carotid endarterectomy has been found to be effective in reducing the risk of recurrent stroke, compared to taking aspirin alone, in patients with 70-99% (NASCET-measured[†])

internal carotid stenosis ipsilateral to a carotid territory transient ischaemic attack or non-disabling ischaemic stroke. Carotid endarterectomy may also benefit selected high-risk patients with symptomatic 50-69% (NASCET-measured) stenosis. The benefit seen with carotid endarterectomy among patients with symptomatic stenosis is generalisable only to surgically fit patients operated on by surgeons with acceptable complication rates.

A Patients with moderate or severe internal carotid artery stenosis ipsilateral to a carotid transient ischaemic attack or non-disabling ischaemic stroke should be considered for carotid endarterectomy by an experienced surgeon.

Grade A, Level 1++

† NASCET = North American Symptomatic Carotid Endarterectomy Trial. The measurement is the diameter of a normal-looking portion of the more distal internal carotid artery minus the diameter of the narrowest portion of the proximal internal carotid artery, divided by the diameter of the normal-looking portion of the more distal internal artery, multiplied by 100.

4.4 Carotid artery stenting

There is still some controversy as to whether carotid artery stenting (CAS) is as effective as carotid endarterectomy (CEA) for secondary prevention of stroke in patients with severe carotid artery stenosis despite the publication of four major trials.[93-96] The SAPPHIRE trial showed that CAS is not inferior to CEA and may be considered as an alternative to CEA in patients who are at increased risk from surgery.[96] However, only 25% of the patients in this trial were symptomatic. A meta-analysis of the major trials showed a significantly higher risk of any stroke and death within 30 days after CAS, compared with CEA (OR, 1.41; CI 1.05 to 1.88, $p < 0.05$).[97] Beyond the 30-day perioperative period, the outcomes of CAS and CEA are comparable.[94,95] Carotid artery stenting is reasonable when performed with operative morbidity and mortality rates of 4% to 6%, similar to that observed in trials of carotid endarterectomy.

A Carotid artery stenting may be considered in patients who are not suitable for carotid endarterectomy.

Grade A, Level 1++

4.5 Intracranial angioplasty and stenting

Symptomatic intracranial atheromatous disease is common locally[98] and is often associated with recurrent events despite medical therapy. In the Warfarin-Aspirin Symptomatic Intracranial Disease (WASID) study, 25% of patients presenting with 70% to 99% stenosis experienced a stroke in the ipsilateral vascular territory within 2 years, despite treatment with either warfarin or aspirin.[99]

The SSYLVIA trial (Stenting of Symptomatic atherosclerotic Lesions in the Vertebral or Intracranial Arteries)[100,101] and WINGSPAN Trial were multi-centre, non-randomized, prospective feasibility studies. Together with another Multicentre US trial[102], they reported successful stent deployment of above 95% and 30-day procedural death and ipsilateral stroke rates of below 7%.

C Intracranial angioplasty with or without stenting may be considered as a treatment option for symptomatic patients who have > 50% stenosis and who have failed medical therapy.

Grade C, Level 2+

4.6 Blood pressure lowering

While aggressive lowering of mild to moderate elevated blood pressure is not recommended during the acute phase of stroke[103], blood pressure reduction commencing beyond the acute phase results in a further reduction of vascular events.[104,105] The benefit is seen in both ischaemic and haemorrhagic stroke, in both hypertensive and non-hypertensive subjects.[106] In patients with diabetes mellitus the blood pressure should be below 130/85 mmHg.[107] Selection of antihypertensive agent should take into consideration other medical co-morbidities.[101] A diet low in salt and high in fruit and vegetables complements pharmacotherapy in lowering blood pressure and reducing the risk of recurrent stroke.[108,109]

A Blood pressure lowering should be considered after the acute phase of stroke.

Grade A, Level 1++

4.7 Lipids

Two large randomised controlled trials have demonstrated that statin therapy reduces vascular events among patients with stroke or transient ischaemic attack.[110,111] In one of these randomised controlled trials, there was a modest increase in incidence of haemorrhagic stroke.[111] Therefore, the relationship between statin therapy and haemorrhagic stroke deserves further investigations.

The target goal for lipid lowering should follow the MOH Lipids Clinical Practice Guidelines (May 2006).[112]

A Patients with ischaemic stroke or transient ischaemic attack are reasonable candidates for treatment with a statin agent to reduce the risk of vascular outcomes. However, caution should be exercised for patients with haemorrhagic stroke.

Grade A, Level 1++

4.8 Diabetes

There are no dedicated secondary stroke prevention trials focusing on anti-diabetic therapy. However, a number of prospective observation studies revealed a positive association between hyperglycaemia and susceptibility to stroke.[113,114] One randomised controlled trial and a high quality observational study suggested hypoglycaemic agents (in particular, metformin in over-weight subjects) is helpful in stroke prevention.[115,116] Hence, glucose control is recommended to near normoglycaemic levels among diabetics with ischaemic stroke or transient ischaemic attack to reduce microvascular complications and possibly macrovascular complications. Diabetes synergizes with other risk factors such as hypertension and lipid disorders in increasing stroke risk.[117] Therefore, global multiple risk factors management is highly effective in the prevention of stroke.[118]

The target goal for glycaemia lowering should follow the MOH Diabetes Mellitus clinical practice guidelines (June 2006). Briefly, the targets of glycaemic control should be defined for each patient, with patient participation in the process. “Optimal” glucose control should be the target for the majority of patients with diabetes. This refers to glucose levels that approach the normal range (HbA1c 6.5-7.0%; preprandial glucose 6.1-8.0 mM).

A&B Glucose control is recommended to near normoglycaemic levels among diabetics with ischaemic stroke or transient ischaemic attack to reduce microvascular complications* and possibly macrovascular complications†.

***Grade A, Level 1+**
†Grade B, Level 2++

4.9 Lifestyle modification

Diet rich in fruits, vegetables, fish oil and low fat dairy products may be beneficial for reducing the risk of ischaemic stroke or transient ischaemic attack.[119,120]

Although there are no randomized control trials of smoking cessation for stroke prevention, observational studies have shown that the elevated risk of stroke due to smoking declines after quitting and is eliminated after 5 years.[121-123] Smoking cessation is recommended for patients with stroke or transient ischaemic attacks.

Alcohol affects the risk of stroke depending on the level of consumption, type of stroke, and possibly ethnicity. Drinking one to two drinks per day appears to reduce risk of ischaemic stroke, while heavy drinking increases the risk.[124,125] For patients with ischaemic stroke or transient ischaemic attack who are heavy drinkers, elimination or reduction of alcohol consumption is recommended, despite the lack of clear evidence from clinical trials.

Epidemiological data suggest that obesity is associated with susceptibility to stroke.[126] Patients who are overweight with ischaemic stroke and transient ischaemic attack should attempt weight reduction.

Evidence from observational studies suggest increase physical activity is protective against stroke.[127,128] Patients who are capable of exercise after stroke or transient ischaemic attack should maintain moderate intensity physical exercise most days of the week for at least 30 minutes.

D&GPP Smoking cessation, limited alcohol consumption, weight control, regular physical activity, and a diet rich in fruits, vegetables, fish oil and low fat dairy products may be beneficial for reducing the risk of ischaemic stroke and transient ischaemic attack.

Grade D, Level 4
GPP

5 Rehabilitation

5.1 Rehabilitation

A systematic review of randomized trials indicated that organized inpatient multidisciplinary rehabilitation was associated with reduced odds of death, institutionalisation and dependency. For every 100 patients that received organized inpatient multidisciplinary rehabilitation, an extra 5 were discharged home in an independent state.[129]

A Stroke patients should receive organized inpatient multidisciplinary rehabilitation.

Grade A, Level 1+

Observational studies have shown that patients with acute stroke benefit from early initiation of stroke rehabilitation in terms of better functional outcome and shorter length of stay.[130-132]

B Stroke patients should receive early rehabilitation.

Grade B, Level 2++

A meta-analysis of studies found that more intensive and longer rehabilitation therapy during the first six months after stroke has a small but favourable effect on functional outcome.[133]

A If able to do so, stroke patients should be encouraged to participate in more intensive rehabilitation particularly in the first six months.

Grade A, Level 1+

Systematic review of 3 randomized controlled trials and 12 nonrandomized studies on in-hospital care pathways for stroke found no significant differences in death, dependency, or discharge destination. The studies suggested care pathway patients were less likely to suffer urinary tract infection or readmitted to hospital, and were more likely to have CT brain or carotid duplex scans. However, patient satisfaction and quality of life may be significantly lower, and there was no significant difference in lengths of stay.[134]

There is presently insufficient evidence for any recommendation on the routine use of care pathways for stroke management including rehabilitation.

From a review of databases of physiotherapy treatment approaches for promoting postural control and lower limb function, a mixed approach was significantly more effective than no treatment at improving functional independence. There was insufficient evidence to support the superiority of any one approach.[135]

A systematic review of randomised controlled trials showed that occupational therapy interventions reduced odds of a poor outcome, and increased activity of daily living (ADL) scores – they were less likely to deteriorate and more likely to be independent in ADLs. However, the exact nature of intervention for maximum benefit is still unclear.[136]

A Stroke rehabilitation should include physiotherapy and occupational therapy.

Grade A, Level 1+

Dysphagic patients with dietary modification and taught swallowing compensation strategies had increased return to normal diet and recovery of swallowing by 6 months, especially with a high-intensity program.[137]

A Dysphagia therapy is recommended for all acute stroke patients with impaired swallowing function.

Grade A, Level 1+

The efficacy of formal speech and language therapy on poststroke communication disorders including aphasia, speech apraxia and dysarthria could not be clearly determined from available literature.[138-141]

D Speech and language therapy may be considered for poststroke communication disorder but there is presently no clear evidence for its efficacy.

Grade D, Level 3

There may be substantial and long-lasting improvement in functional use of the paretic upper limb with constraint-induced movement therapy (CIMT).[142,143]

A Constraint-induced movement therapy is recommended for patients with upper limb paralysis who are able to tolerate the treatment regime.

Grade A, Level 1+

A systematic review of 15 trials found no statistically significant differences between treadmill training, with or without body weight support, and other interventions for walking speed or dependence were found. Subjects who could walk independently at the start of treatment tended to have higher walking speeds, and dependent walkers tended to do better with treadmill training using body weight support.[144]

A systematic review of randomized unconfounded clinical trials in subacute and chronic stroke subjects comparing acupuncture needling with placebo, sham, or no acupuncture found 5 trials with 368 patients, none of which had adequate methodological quality.[145]

C Body weight support treadmill ambulation or acupuncture may be considered but there is presently no clear evidence for its efficacy.

Grade C, Level 2+

6 Implications for service delivery

6.1 Stroke assessment clinics

Stroke clinics facilitate the outpatient evaluation of suspected stroke/transient ischaemic attack patients, as well as the follow-up of patients confirmed to have had a stroke. Early initiation of existing treatments after transient ischaemic attack or minor stroke was associated with a reduction in the risk of early recurrent stroke.[146] Use of transient ischaemic attack clinics with 24-hour access and immediate initiation of preventive treatment might reduce length of hospital stay and risk of stroke.[147]

A Patients with transient ischaemic attack or minor stroke should be referred for urgent assessment in specialised clinics.

Grade A, Level 1+

6.2 Admission policies

A meta-analysis of trials comparing the management of patients with acute stroke in specialised units and in general medical units has shown that the management of patients with stroke in a stroke unit is associated with a reduction in death, dead or disability, and death or institutionalisation. More patients managed in stroke units are discharged home and remain at home.[148] Benefits occur by reducing death from secondary complications of stroke and reducing the need for institutional care through a reduction in disability.[149,150]

In the majority of these trials, stroke care was provided in a designated area or ward, as opposed to a roving stroke care team. Members of the multidisciplinary team could include nurses, physiotherapists, occupational therapists, speech therapists, dietitians, medical social workers, case managers and patient educators.

A Patients who have suffered an acute stroke should be admitted to a Stroke Unit.

Grade A, Level 1++

6.3 Organisation of care for patients admitted to hospital with a stroke

The 1996 Declaration of Helsingborg called for organisation of stroke care by a multidisciplinary service.[151] Care of patients with stroke in a specialized unit has been shown to reduce mortality and dependency.[152,153] Patients with stroke requires rapid investigation and diagnosis, safe use of proven acute treatment strategies, optimal nursing care, planning of secondary prevention, prompt assessment of neurological impairment and disability, and involvement of a multidisciplinary team.

Systems of stroke care, including primordial and primary prevention, community education, notification and response of emergency medical services, acute stroke treatment, subacute stroke treatment and secondary prevention, rehabilitation, and continuous quality improvement activities must be established.[154] Important components of primary stroke centres are acute stroke team, written care protocols, emergency medical services, emergency department, stroke unit, neurosurgical service, commitment and support of medical organization, neuroimaging services, laboratory services, outcome and quality assessment activities, and continuing medical education.[155] In addition to these, comprehensive stroke centres should integrate expert health care personnel, advanced neuroimaging capabilities, surgical and endovascular techniques, and other specific infrastructure and programmatic elements such as an intensive care unit and a stroke registry.[156]

A Acute inpatient care for patients admitted to hospital with a stroke should be organised as a multidisciplinary stroke service based in designated stroke units.

Grade A, Level 1++

7 Cost-effectiveness issues

Lifetime cost per person for treatment of ischaemic stroke in the United States (US) in 1990 was about US$90,981.

In Australia the cost of stroke treatment per annum was estimated to be Aus$40,000 in 1993-1994.[157] Many of the therapies discussed in this guideline for treatment of acute ischaemic stroke and secondary prevention have been shown to be cost-effective.

A study from Australia showed that treating acute ischaemic stroke with rtPA costs Aus$36,000 to avoid one case of death or dependency. However, it costs only Aus$83 to avoid a similar outcome with aspirin.[157] For the first 5 years after stroke, a French study estimated that stroke units cost €1,359 more than conventional care for every year of life gained without disability.[158]

For secondary prevention of ischaemic stroke, the estimated yearly costs required to prevent one stroke are as follows: smoking cessation Aus$0, smoking cessation with nicotine patch for 3 months Aus$19,600, aspirin for all in sinus rhythm Aus$2,000, aspirin plus dipyridamole for all in sinus rhythm Aus$18,500, clopidogrel for all in sinus rhythm Aus$74,000, anticoagulation for atrial fibrillation Aus$1,200, diuretics for hypertension Aus$1,350, ACE inhibitor for hypertension Aus$18,000, statins for hypercholesterolaemia Aus$41,000, and carotid endarterectomy for severe stenosis Aus$128,000.[157] A study from the US showed that lifetime costs of a patient with transient ischaemic attack associated with severe carotid stenosis was US$26,535.79 without treatment and US$23,538.29 after carotid endarterectomy.[159]

As most patients with acute ischaemic stroke are eligible for aspirin compared to rtPA which has a very narrow therapeutic time window, aspirin is the most cost-effective treatment for reducing death and dependency in the population. For secondary stroke prevention, the four most cost-effective interventions are smoking cessation, blood-pressure lowering with diuretics, aspirin for non-cardioembolic stroke, and anticoagulants for patients with atrial fibrillation.

8 Clinical quality improvement

The following clinical quality improvement parameters, based on the recommendations in this guideline, are proposed:

1. Proportion of patients admitted to the stroke unit (pg 31).

2. Proportion of stroke patients undergoing CT or MRI head within 24 hours of admission (pg 14).

3. Proportion of stroke patients undergoing screening for swallowing disorders (pg 12)

4. Proportion of patients with non-cardioembolic stroke started on antiplatelet medication at discharge (pg 22).

5. Proportion of stroke patients with atrial fibrillation started on anticoagulation at discharge (pg 23).

6. Proportion of stroke patients with hyperlipidemia started on statin therapy at discharge (pg 26).

7. Proportion of eligible stroke patients receiving intravenous rtPA therapy (pg 15).

8. Proportion of patients screened for need of inpatient multidisciplinary stroke rehabilitation (pg 28).

9. Proportion of patients with TIA or minor stroke presented to outpatient clinics referred for urgent assessment in specialised clinics or emergency departments (pg 31).

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Self-assessments (MCQs)

After reading the Clinical Practice Guidelines, you can claim one CME point under Category III (Self-Study) of the SMC Online CME System. Before you login to claim the CME point, we encourage you to evaluate whether you have mastered the key points in the Guidelines by completing this set of MCQs. This is an extension of the learning process and is not intended to "judge" your knowledge and is not compulsory. The answers can be found at the end of the questionnaire.

Instruction: Choose "True" or "False

		True	False
1.	What is the recommended target blood pressure for secondary stroke prevention in patients with ischaemic stroke associated with diabetes mellitus?		
	A) < 220/120 mmHg	☐	☐
	B) < 160/90 mmHg	☐	☐
	C) < 130/85 mmHg	☐	☐
	D) < 90/70 mmHg	☐	☐
2.	The following are options of reperfusion therapy in acute ischaemic stroke. Which of them was/were proven effective in improving clinical outcome in randomized clinical trial(s)?		
	A) Intravenous TPA initiated within 3 hours of stroke onset.	☐	☐
	B) Intravenous TPA initiated 3-4.5 hours of stroke onset.	☐	☐
	C) Intravenous TPA in patients with perfusion-diffusion mismatch on MRI initiated 3-6 hours after stroke onset.	☐	☐
	D) Intra-arterial pro-urokinase initiated within 6 hours of stroke onset.	☐	☐
	E) Mechanical retrieval of clot using MERCI device initiated within 8 hours of stroke onset.	☐	☐

		True	False
3.	Cholesterol lowering therapy using HMGCoA reductase inhibitor (statin) is:		
	A) recommended for ischemic stroke	☐	☐
	B) recommended for haemorrhagic stroke	☐	☐
	C) associated with increased risk of cancer	☐	☐
	D) associated with progressive kidney injury	☐	☐
4.	A doctor trying to decide on brain imaging for his patient with acute stroke will often consider the following:		
	A) A careful clinical history and examination can reliably differentiate an ischemic stroke from a haemorrhagic stroke without CT or MRI imaging.	☐	☐
	B) CT brain scan is useful in acutely ill and restless patient because imaging time is very short.	☐	☐
	C) CT brain imaging can demonstrate brain infarcts earlier than MRI brain imaging.	☐	☐
	D) MRI brain imaging is more sensitive in detecting small strokes than CT brain imaging.	☐	☐
5.	Deep vein thrombosis can be prevented by:		
	A) Early mobilisation and good hydration.	☐	☐
	B) Compressive leg stockings.	☐	☐
	C) Mechanical compression devices like foot/ calf pumps.	☐	☐
	D) Aspirin.	☐	☐
	E) Low molecular weight heparin.	☐	☐
	F) No treatment is needed as it is very rare in Singapore stroke patients.	☐	☐

		True	False
6.	The secondary prevention of stroke in non-valvular atrial fibrillation is most efficacious with:		
	A) Aspirin.	☐	☐
	B) A combination of Aspirin and Clopidrogel.	☐	☐
	C) Adjusted dose long-term anticoagulation with warfarin.	☐	☐
	D) Low molecular weight heparin.	☐	☐
7.	How many extra patients are discharged home independent for every 100 stroke patients who undergo organised inpatient multidisciplinary rehabilitation?		
	A) 0	☐	☐
	B) 5	☐	☐
	C) 20	☐	☐
	D) 50	☐	☐
8.	Stroke rehabilitation should include:		
	A) Physiotherapy	☐	☐
	B) occupational therapy	☐	☐
	C) dysphagia therapy in acute stroke patients with impaired swallowing function	☐	☐
	D) CIMT in patients with upper limb paralysis who are able to tolerate the treatment regime	☐	☐

Answer

1	A)	False	pg 25
1	B)	False	
1	C)	True	
1	D)	False	
2	A)	True	pg 13, 15, 16
2	B)	True	
2	C)	False	
2	D)	True	
2	E)	False	
3	A)	True	pg 25, 26
3	B)	False	
3	C)	False	
3	D)	False	
4	A)	False	pg 12, 13
4	B)	True	
4	C)	False	
4	D)	True	
5	A)	True	pg 20, 21
5	B)	False	
5	C)	True	
5	D)	True	
5	E)	True	
5	F)	False	
6	A)	False	pg 22, 23
6	B)	False	
6	C)	True	
6	D)	False	
7	A)	False	pg 28
7	B)	True	
7	C)	False	
7	D)	False	
8	A)	True	pg 29, 30
8	B)	True	
8	C)	True	
8	D)	True	

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ISBN no : 978-981-08-3686-3